

SafeStat

Safe|ty

Stat|us

Measurement System

(Version 8.1)

What is SafeStat?

- SafeStat is a **data-driven analysis system** that determines the **current relative safety status** of individual motor carriers
- SafeStat was developed at the Volpe Center for the Federal Motor Carrier Safety Administration (FMCSA)
- Data used are maintained and managed at the Federal level by the FMCSA

Uses of SafeStat

- FMCSA Compliance Reviews (CRs):
 - » Semiannually identifies and prioritizes carriers for on-site FMCSA compliance reviews
- PRISM Program:
 - » Identifies and monitors poorly performing carriers for the PRISM Federal/State safety improvement process (MCSIP)
- Inspection Selection System (ISS):
 - » Supports recommendation of evaluated carriers' drivers and vehicles for roadside inspections
- A&I Online (www.ai.volpe.dot.gov)
 - » Makes SafeStat results available via the internet to industry and the public to promote safety awareness and self-improvement

SafeStat Methodology

- involves **analytically assessing** a motor carrier in four **Safety Evaluation Areas (SEAs)**:
 - » **Accident SEA**
 - » **Driver SEA**
 - » **Vehicle SEA**
 - » **Safety Management SEA**
- **each SEA is based on two or more indicators supported by different data sources**

SafeStat Design

- **Event and exposure data** are used to calculate normalized **measures** for each carrier
- **Measures** are ranked and assigned percentile values (**Indicators**) from 0-100-with 100 being highest or worst
- **Indicators** are combined into **SEA values**
- **SEA values** are weighted and summed to derive the **SafeStat score**

SafeStat Hierarchy and Features

- The **SafeStat** algorithm design is computationally **hierarchical** beginning with **safety event data** building to a **SafeStat Score**
- Algorithm **features** **data sufficiency tests, normalization and weighting**

SafeStat Hierarchy and Features

Features

Time-Weighting

Percentile Ranking

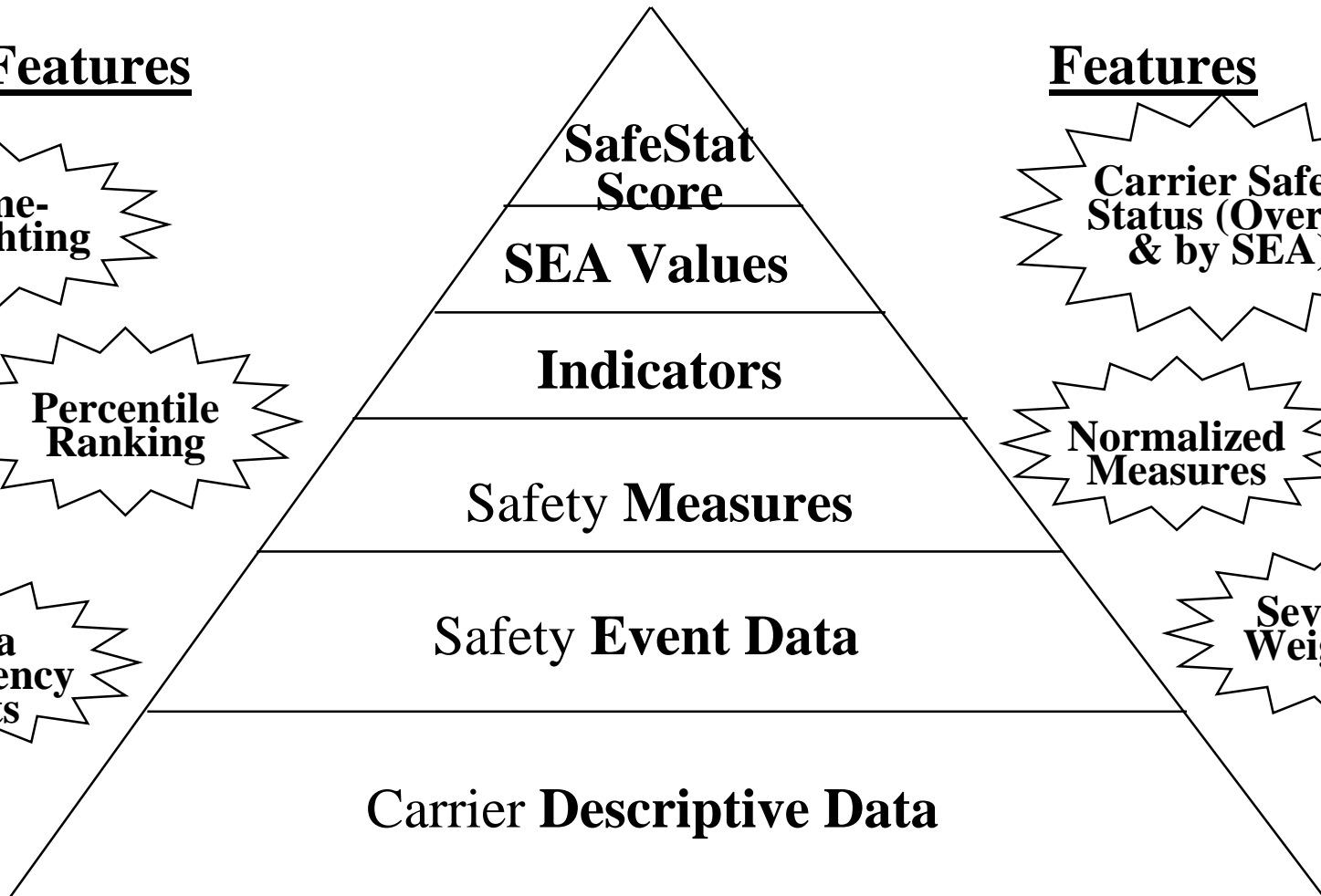
Data Sufficiency Tests

Features

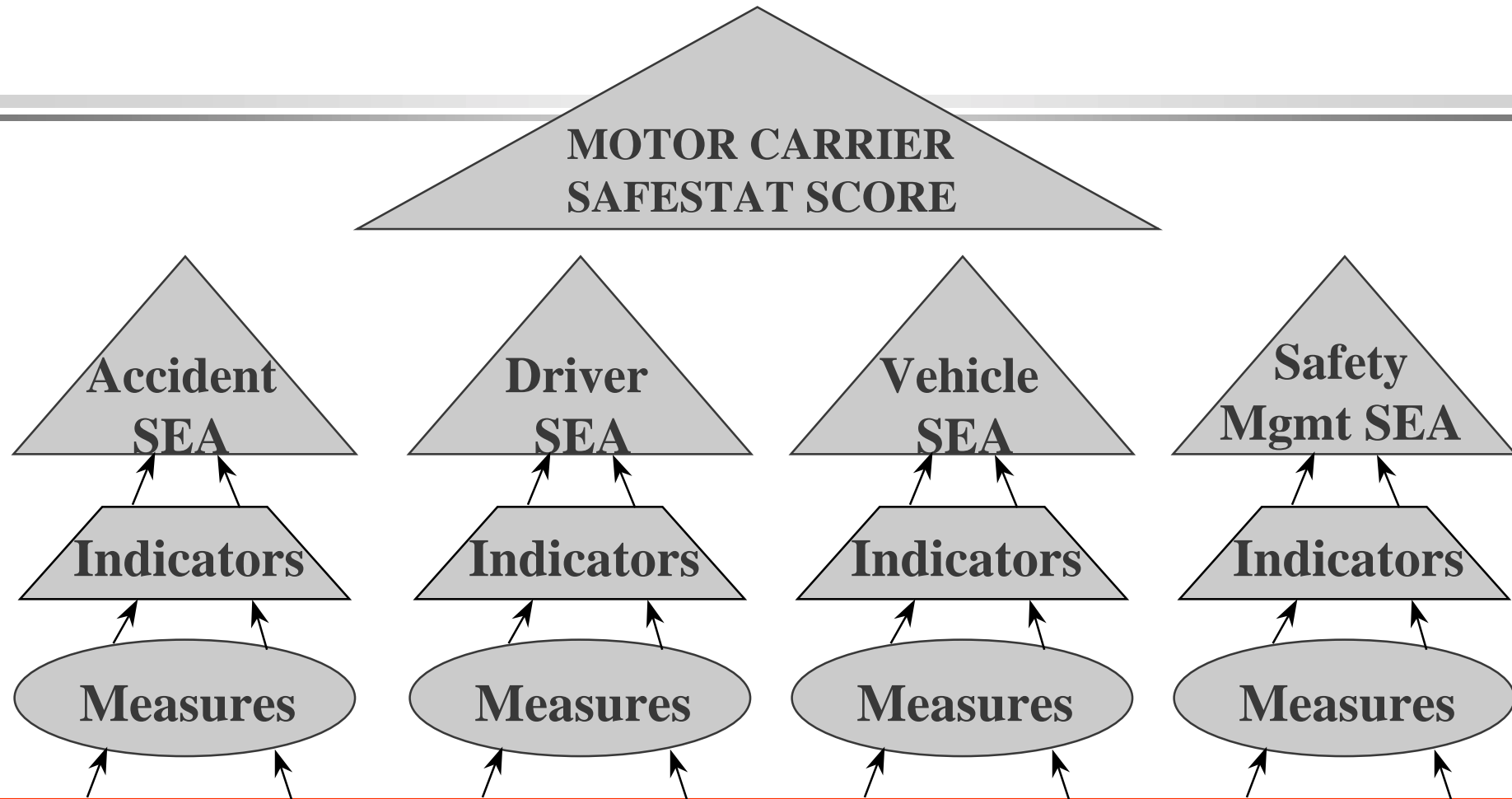
Carrier Safety Status (Overall & by SEA)

Normalized Measures

Severity-Weighting



SafeStat Overview



Data Sources by Carrier

State Reported &
FMCSA Collected
Truck Crashes

Moving
Violations

Out-of-Service
Violations from
Roadside Inspections

Violations from onsite
Compliance Reviews

Closed Enforcement
Cases

SafeStat Data

At the foundation of SafeStat are **safety event data** and **exposure data**

- » Carrier specific **safety event data** reflect the carrier's safety compliance and performance and include:
 - State Reported Crashes (last 30 mos.)
 - Recordable Crashes from CRs (last 12 mos. CRs)
 - Roadside Inspection Violations (last 30 mos.)
 - Serious Moving violations (last 30 mos.)
 - Compliance Review Violations (last 18 mos. CRs)
 - Closed Enforcement Cases (complete history)
- » **Exposure data normalize** a carrier's safety event data:
 - Number of drivers/vehicles and VMT
 - Number of inspections

SafeStat Measures

- Safety **measures** are the result of normalizing safety event data
- Example: **accident event data** are converted to **accident rates** which take into account differences in **exposure**

SafeStat Indicators

- **Indicators** rank carriers by their safety **measures** converted to a percentile (0-100) scale.
- When determining **indicators**, SafeStat may employ peer groupings that reflect differences in operations to assure appropriate comparisons among carrier types and size classes

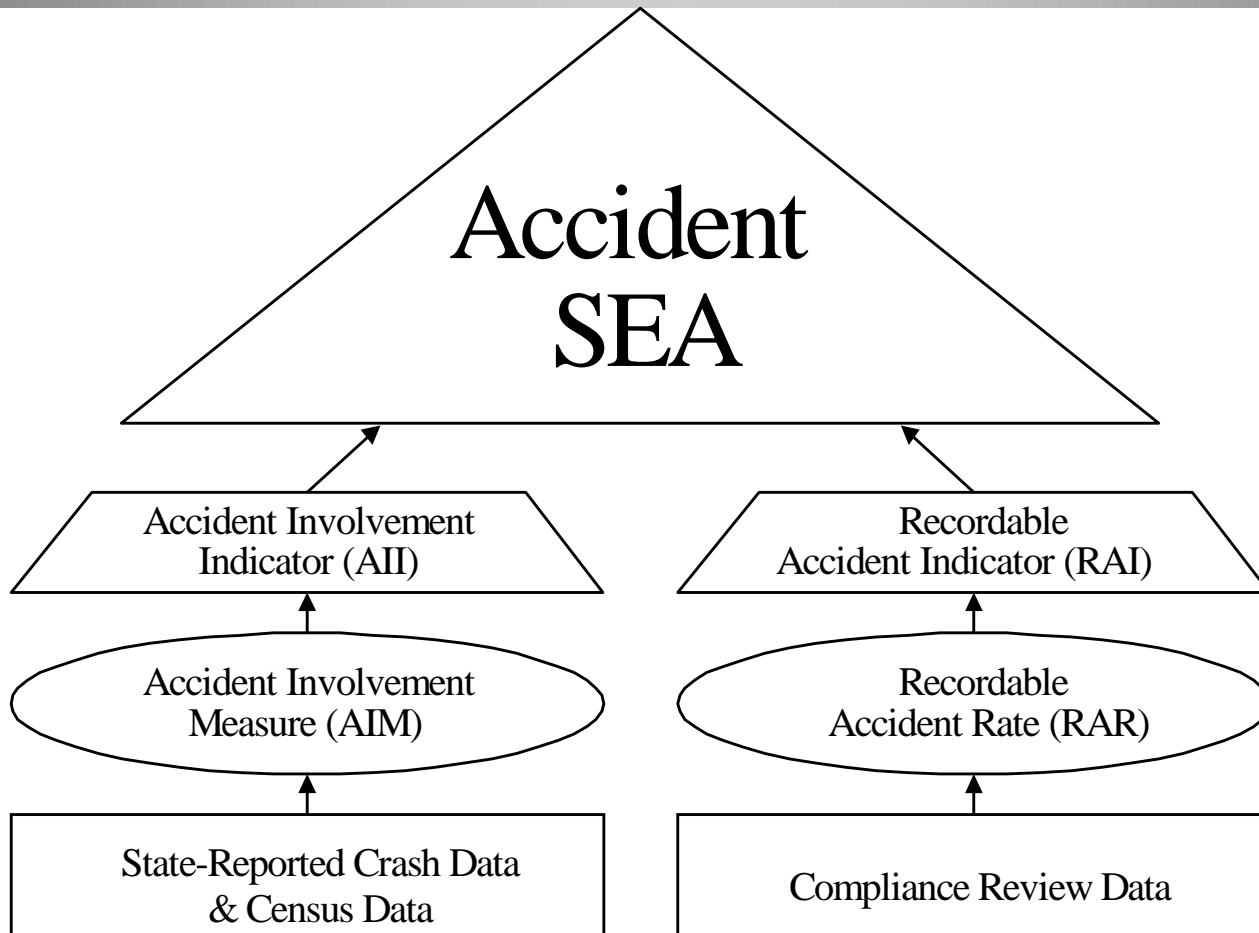
SafeStat SEA Values

- **Safety Evaluation Areas (SEAs)** represent the four major criteria used to evaluate carriers' safety status
- A **SEA Value**, also on a 0-100 percentile scale, is derived from the **Indicators** related to that SEA
- For example a *SEA Value of 85* means:
 - 85% of the carriers (that have sufficient data) have a better safety status in that SEA*
 - 15% have a worse safety status*

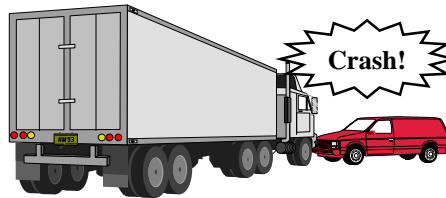
SafeStat SEAs

- Accident
- Driver
- Vehicle
- Safety Management

Accident SEA Summary



Accident SEA

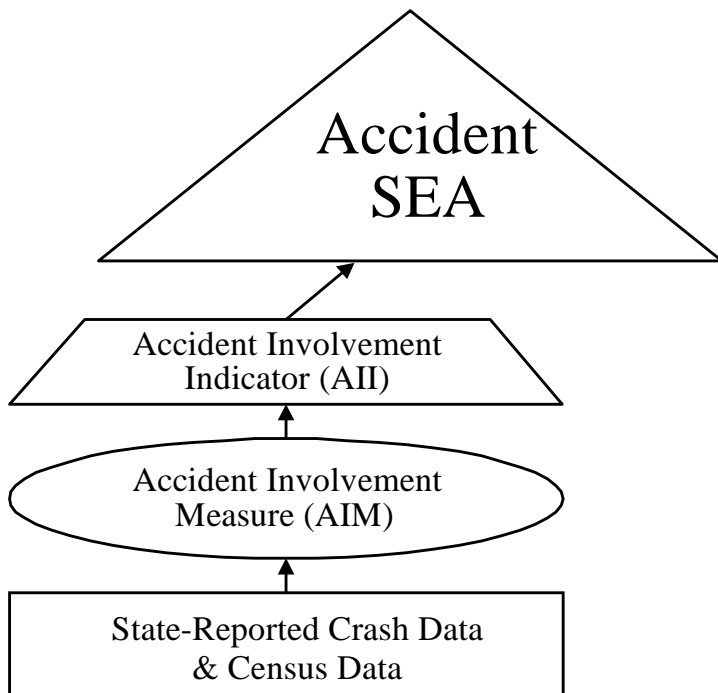


Data & Measures

- **State reported crashes (using NGA standard)** over past 30 months normalized by **# of power units** from FMSCA carrier registration data yield the **Accident Involvement Measure (AIM)**
- **Recordable crashes** from Compliance Reviews (CRs) conducted during the previous 12 months normalized by **vehicle miles traveled (VMT)** yield the **Recordable Accident Rate (RAR) Measure**

Accident SEA

Accident Involvement Indicator (All)

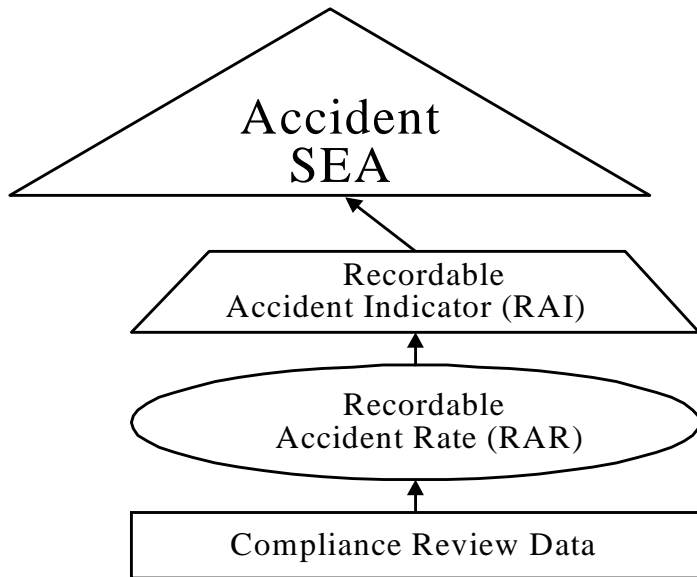


- Accident Involvement Measure (AIM) applies time weighting (most recent crashes have greatest weight) and severity weighting (crashes involving injury/fatality and/or HM release have more weight)

- All is percentile ranking of weighted AIM

- Carriers are peer-grouped by similar # of crashes and ranked on a percentile basis to obtain an All

Accident SEA - Recordable Accident Indicator (RAI)



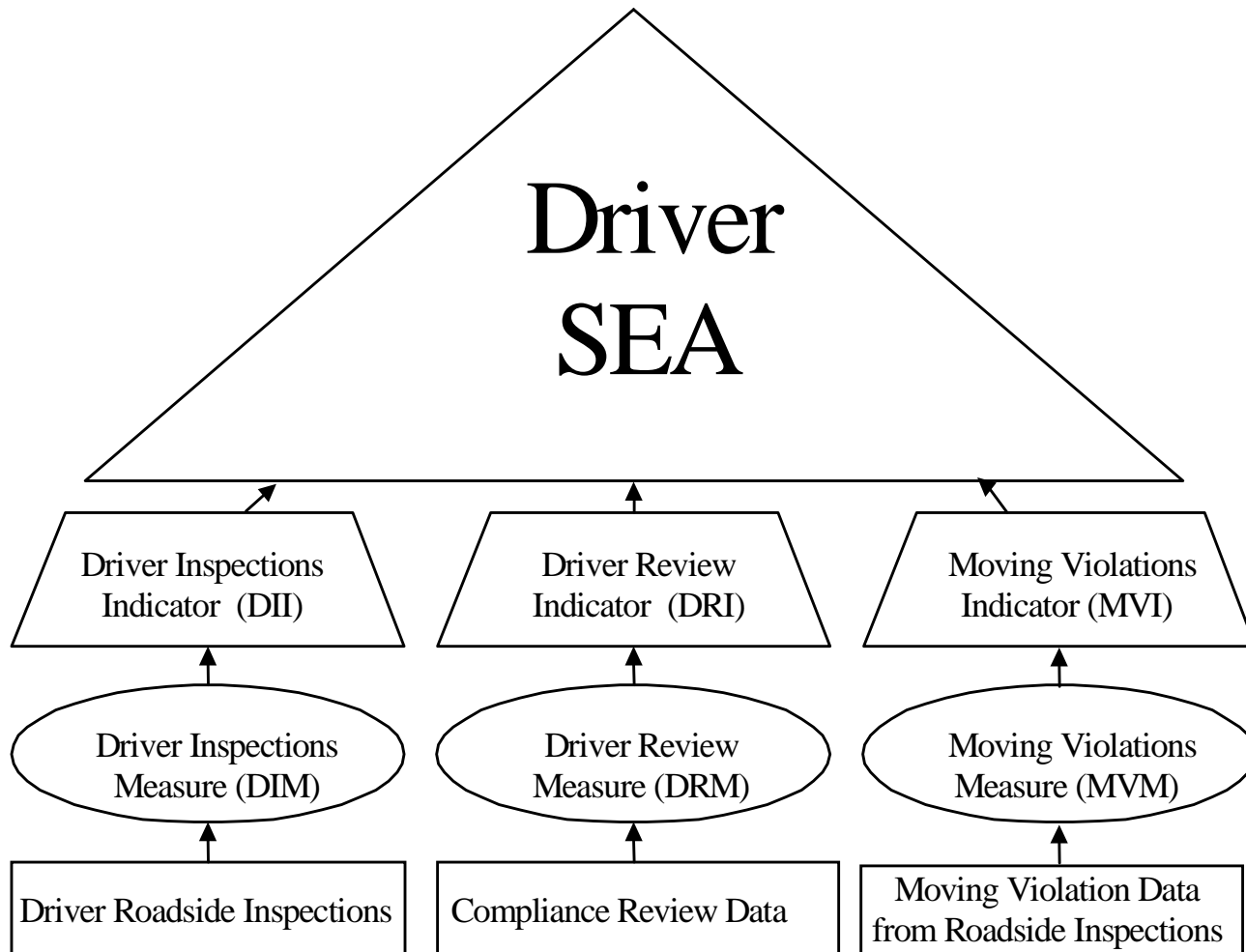
- # of Recordable Crashes and last 12 months VMT data are gathered during CR
- Recordable crashes are divided by VMT and multiplied by 1 million to obtain a Recordable Accident Rate (RAR) per million miles traveled.
- Carriers are peer-grouped by similar # of crashes and then ranked on a percentile basis to obtain the RAI

Accident SEA Value Calculation



- For Carriers with no CR within past 12 months:
 - » Accident SEA = AII
- Carriers with CR within past 12 months and no state-reported crashes since the CR
 - » Accident SEA = RAI
- Carriers with CR within past 12 months and at least one state-reported crash since the CR
 - » Accident SEA = highest of (AII, RAI)

Driver SEA Summary



Driver SEA

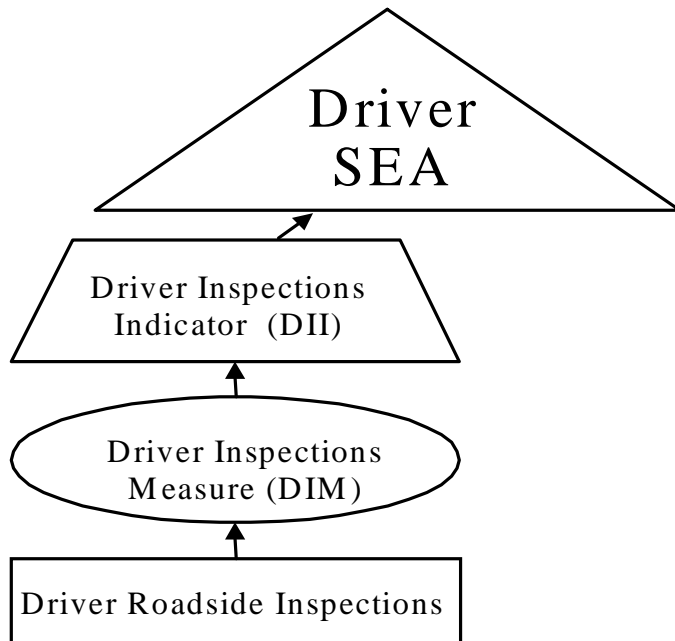


Data and Measures:

- **Driver OOS Violations** normalized by number of roadside inspections over past 30 months yield the **Driver Inspection Measure (DIM)**
- **Driver-Related Critical and Acute Violations** from CRs completed within past 18 months yield the **Driver Review Measure (DRM)**
- **Serious Moving Violation Citations** over past 30 months normalized by number of drivers yield the **Moving Violation Measure (MVM)**

Driver SEA

Driver Inspection Indicator (DII)

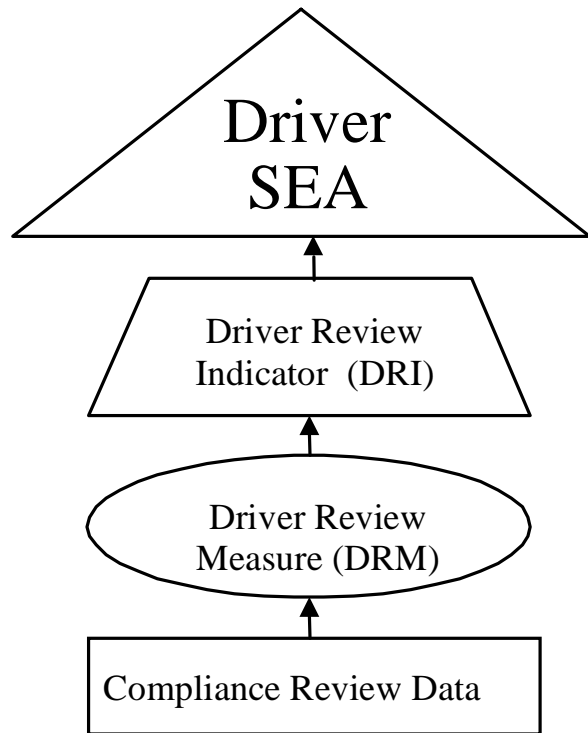


- DIM is based on OOS inspections that are severity-weighted (based on # of DOOS viol.) and time-weighted:

0-6 months old # of inspections (3x)
7-18 months old # of inspections (2x)
19-30 months old # of inspections (1x)

- DIM is adjusted up for violations of OOS orders (aka jumping OOS orders)
- Carriers are peer-grouped by similar # of driver inspections
- DII is percentile ranking of DIM

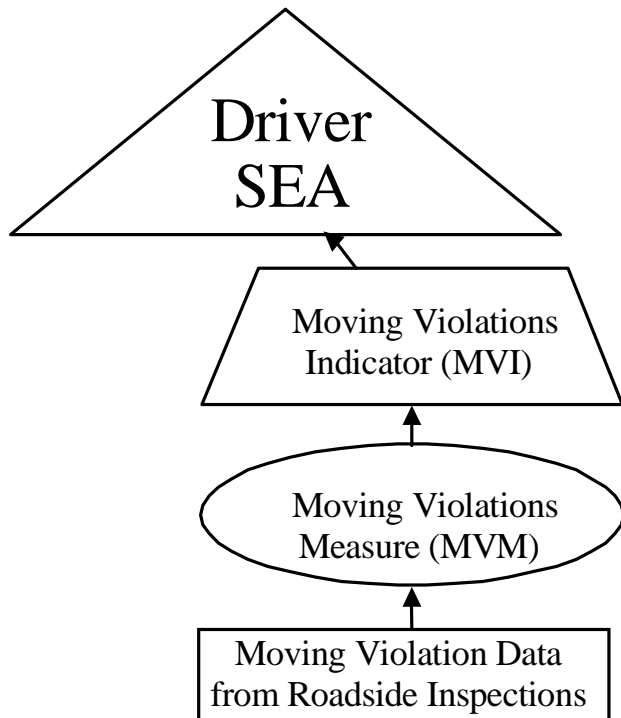
Driver SEA - Driver Review Indicator (DRI)



- Driver Review Measure (DRM) is based on violations of driver-related Critical and Acute Regulations from CRs
- DRM accounts for the number and severity of violations
- DRI is percentile ranking of DRM

- Carriers with CR and no violations are given a DRI of 0

Driver SEA - Moving Violations Indicator (MVI)



- MVM is based on serious Moving Violation (MV) citations issued in conjunction with roadside inspections normalized by the number of drivers

Time weighting is applied to violations:

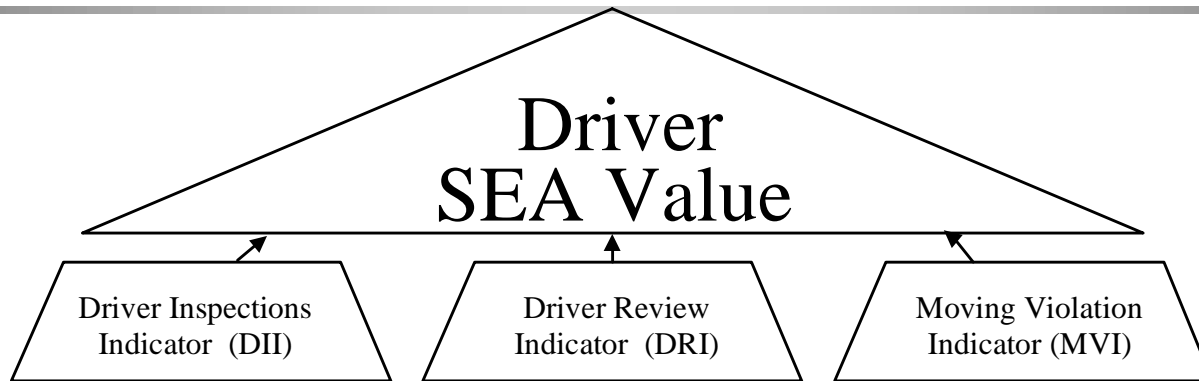
0-6 months old # of MVs (3x)

7-18 months old # of MVs (2x)

19-30 months old # of MVs (1x)

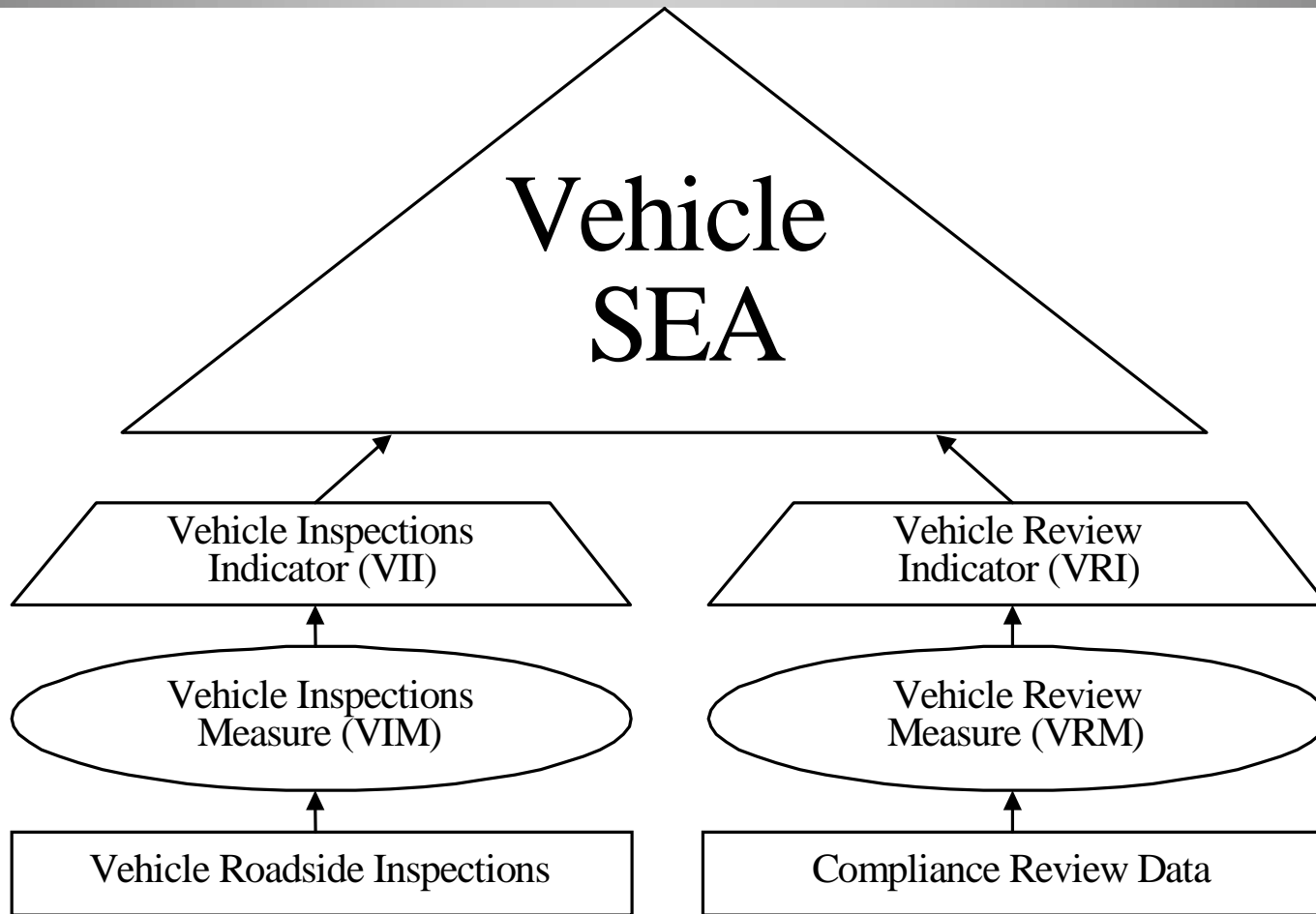
- Carriers are peer-grouped by similar # of MVs
- MVI is percentile ranking of MVM

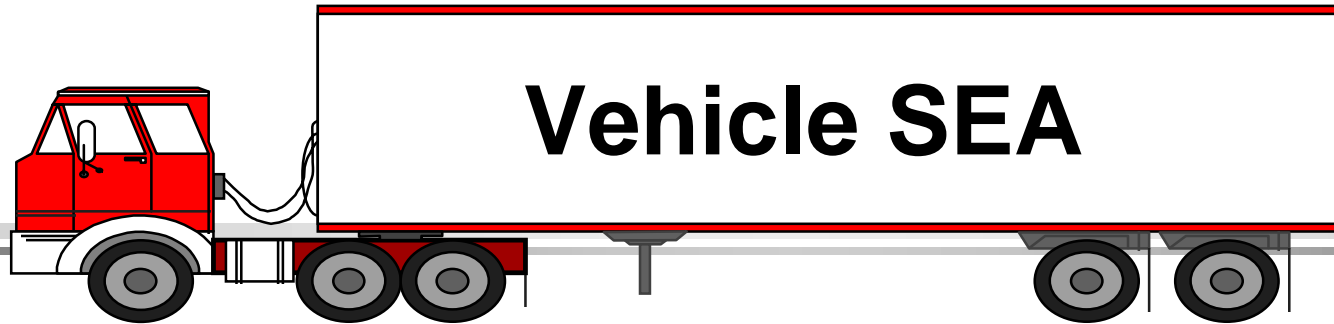
Driver SEA Value Calculation



- Driver SEA Value is the **highest** of the DII and DRI and uses the MVI when its value is greater than the DII and DRI
- When the MVI is greater than the DII and DRI, Driver SEA is equal to the weighted average of MVI and the highest of the DII and DRI.

Vehicle SEA Summary

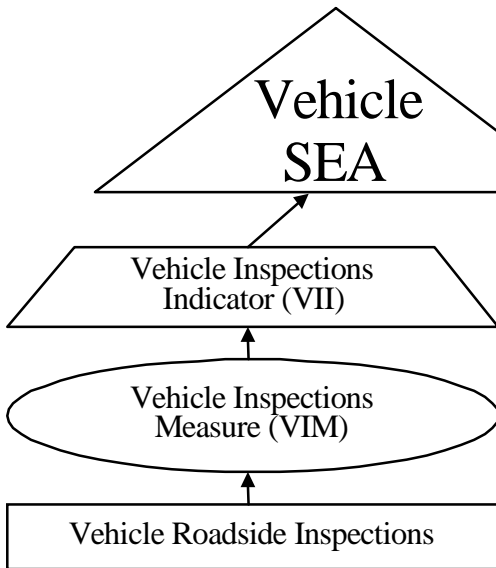




Data and Measures:

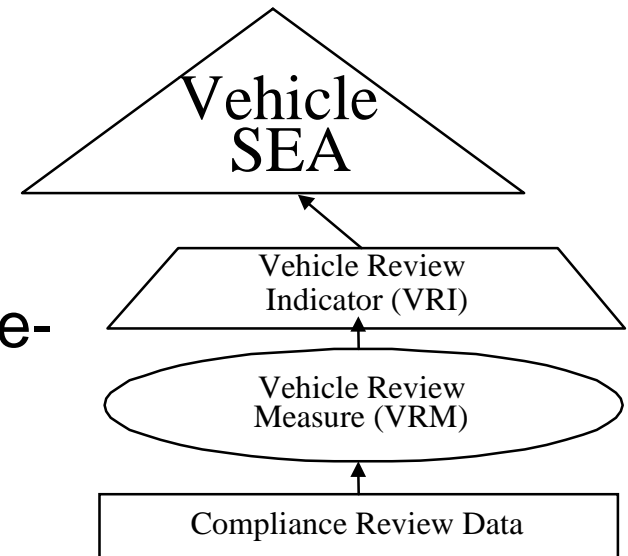
- **Vehicle OOS Violations** normalized by number of roadside inspections over past 30 months yield the **Vehicle Inspection Measure (VIM)**
- **Vehicle-related Critical and Acute Violations** from CRs completed within past 18 months yield the **Vehicle Review Measure (VRM)**

Vehicle SEA - Indicators VII & VRI

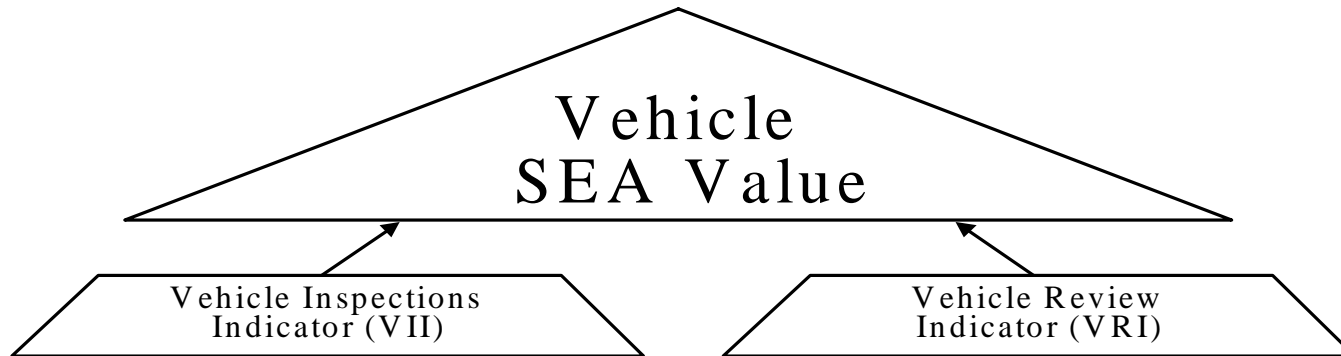


- VII is similar to DII but uses Vehicle OOS violations instead of Driver OOS violations

- VRI is similar to DRI but uses Vehicle-related violations of Acute/Critical regulations

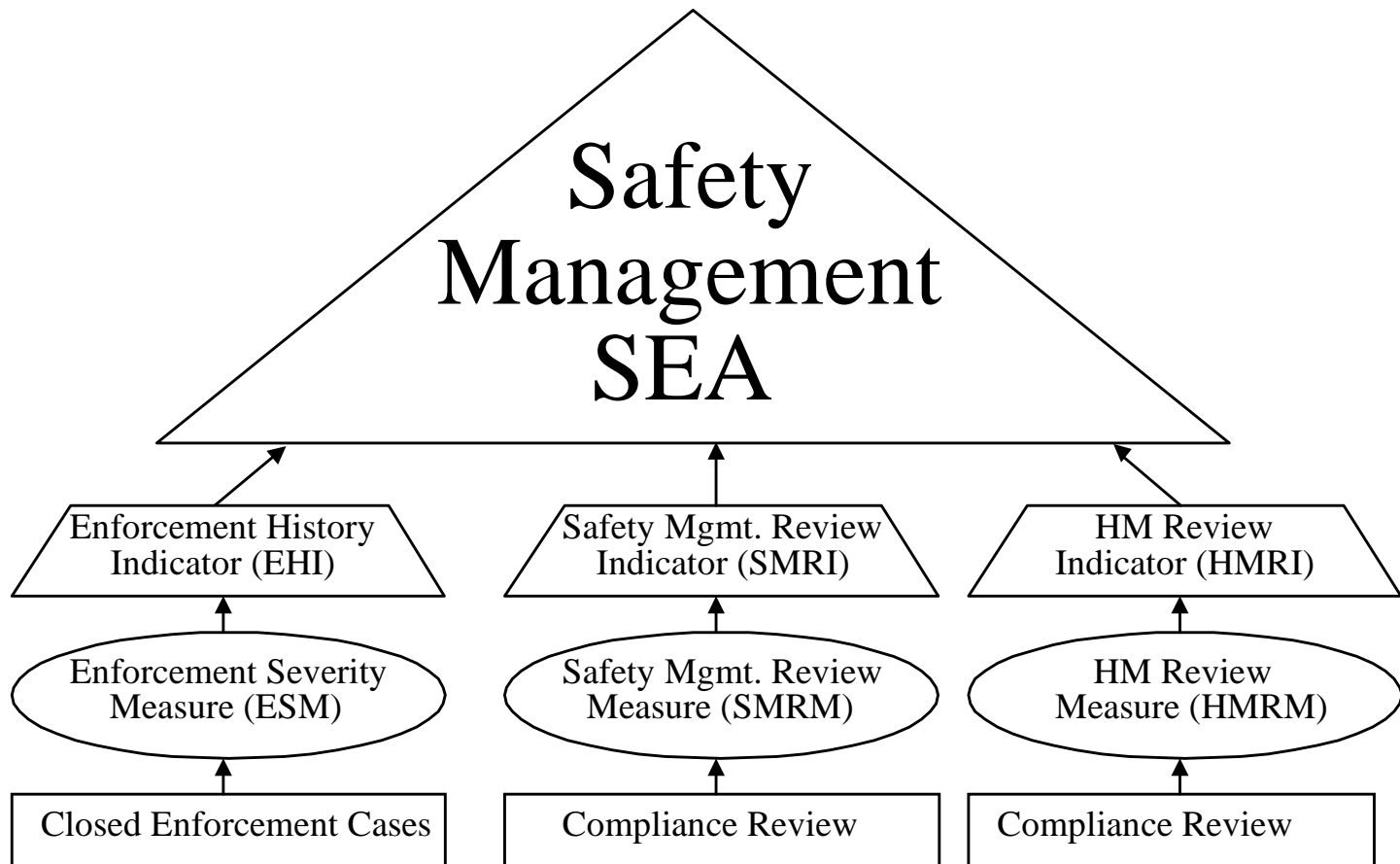


Vehicle SEA Value Calculation



- Vehicle SEA Value is the **highest** of the VII and VRI.

Safety Management SEA Summary



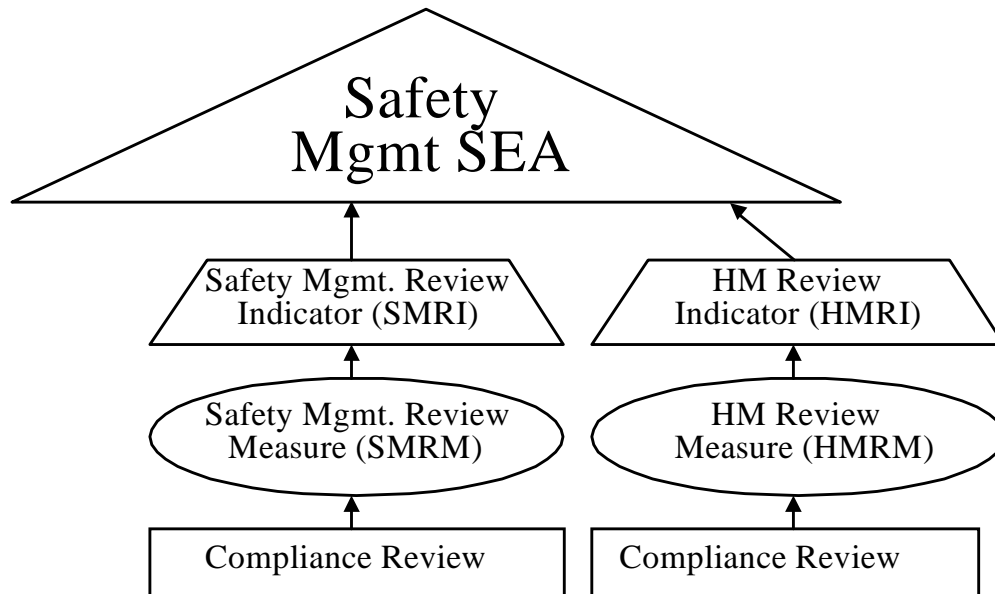
Safety Management SEA



Data and Measures:

- Safety Management/HM **Critical and Acute Violations** from CRs completed within past 18 months yield the **Safety Mgmt Review Measure (SMRM)** and the **HM Review Measure (HMRM)**
- SMRM and HMRM account for the number and severity of violations
- **Closed Enforcement Cases** are used to determine the **Enforcement Severity Measure (ESM)**

Safety Mgmt SEA - Indicators SMRI & HMRI

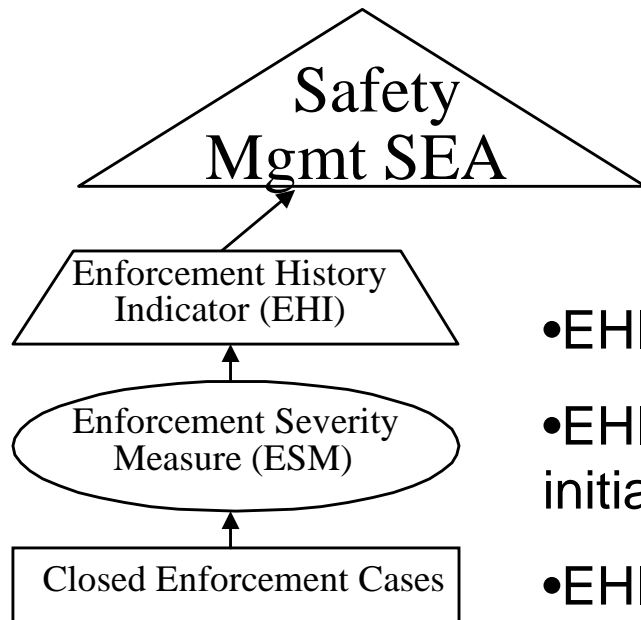


- SMRI is similar to DRI but uses Safety Management-related violations of Acute/Critical regulations

- HMRM is similar to DRI but uses Hazardous Material-related violations of Acute/Critical regulations

Safety Mgmt SEA - Enforcement History Indicator (EHI)

- Enforcement severity measure (ESM) includes severity weighting (based on # of violations cited) and time weighting:



0-12 months old cases (4x)
13-30 months (3x)
31-50 months (2x)
51-72 months (1x)

- EHI is percentile based on ESM rank
- EHI of 75-100 assigned to carriers w/enforcements initiated within the past 30 months.
- EHI of 50-74 assigned to carriers ¹with latest enforcement older than 30 months or ²to carriers with enforcement and most recent CR resulting in no violations of acute/critical regulations.

Safety Mgmt SEA Value Calculation



Safety Management SEA Value is the **highest** of the EHI, SMRI & HMRI

SafeStat Detailed Summary

Motor Carrier SafeStat Score

Safety Evaluation Areas

Accident SEA

Indicators:
RAI, AII

Safety Data:

State-Reported Crashes
Recordable Crashes (Last CR)

Normalizing Data

**Number of Power Units Owned &
Term-Leased** (MCS-150 Census
Data)
Vehicle Miles Traveled (Last CR)

Driver SEA

Indicators:
DRI, DII, MVI

Safety Data:

Driver Violations (Critical & Acute
from last CR)

Driver OOS Violations (Roadside
Inspections)

Jumping OOS Orders
(Roadside Inspections)

Moving Violations
(Roadside Inspections)

Normalizing Data

**Number of Driver Roadside
Inspections**
of Drivers (MCS-150 Census
Data)

Vehicle SEA

Indicators:
VRI, VII

Safety Data:

Vehicle Violations (Critical &
Acute from last CR)

Vehicle OOS Violations
(Roadside Inspections)

Normalizing Data

**Number of Vehicle Roadside
Inspections**

Safety Mgmt SEA

Indicators:
SMRI, EHI, HMRI

Safety Data:

Safety Mgmt Violations (Critical &
Acute from Last CR)

HAZMAT Violations (Critical &
Acute from Last CR)

**Enforcement History Closed
Cases**
(Enforcement Database)

HAZMAT OOS Violations*
(Roadside Inspections)

* Pending HM inspection
normalizing data

SafeStat Results

- The SafeStat Score
- Assignment of Carriers to Categories
 - » Scored carriers
 - » Single SEA carriers
- Example of SafeStat Results
- Effectiveness Study

The SafeStat Score

- The **SafeStat score** only applies to carriers with safety deficiencies
- Only carriers that have deficient SEA values of 75 and higher (the worst 25th percentile) in **two or more** of the four **SEAs** receive a **SafeStat Score**

SafeStat Score Calculation

- A carrier must have **two or more SEAs** with a value of **75 or greater** (worst 25th percentile)
- SafeStat **sums only the SEAs with values of 75 or greater** to determine the **SafeStat Score**
- More emphasis is put on the **Accident SEA** (twice the weight) and **Driver SEA** (1.5 greater weight) than Vehicle and Safety Mgmt SEAs

The diagram illustrates the SafeStat Score calculation formula. On the left, a triangle labeled "SafeStat Score" is followed by an equals sign. To the right of the equals sign are four triangles, each representing a different type of SEA. The first triangle is labeled "Acc. SEA" and is preceded by "2 X". The second triangle is labeled "Driver SEA" and is preceded by "+1.5 X". The third triangle is labeled "Vehicle SEA" and is preceded by a plus sign. The fourth triangle is labeled "Safety Mgmt. SEA" and is preceded by a plus sign. The formula is:
$$\text{SafeStat Score} = 2 \times \text{Acc. SEA} + 1.5 \times \text{Driver SEA} + \text{Vehicle SEA} + \text{Safety Mgmt. SEA}$$

SafeStat Categories for Scored Carriers

SafeStat evaluated carriers are assigned to **Categories (A-G)** based on their SafeStat Scores and SEA Values

SafeStat Categories for Scored Carriers

| Categories | SafeStat Score Range | Includes SEA Values of 75 or Higher |
|------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------|
| A | 350-550 ≥ 350 to ≤ 550 | All 4 SEAs 3 SEAs that result in weighted score of 350 or more. |
| B | 225-350 ≥ 225 to < 350 | 3 SEAs that result in weighted score of less than 350. 2 SEAs that result in weighted score of 225 or more. |
| C | ≥ 150 to < 225 | 2 SEAs that result in weighted score less than 225. |

Single-SEA

SafeStat Categories

Categories of carriers deficient in one SEA (SEA Value of 75 or higher)

SafeStat Categories for Carriers with One SEA Value

| Single SEA Categories | Specific SEA | SEA Value |
|-----------------------|-------------------|-----------|
| D | Accident | 75-100 |
| E | Driver | 75-100 |
| F | Vehicle | 75-100 |
| G | Safety Management | 75-100 |

Example of SafeStat Results

Name: Rollemover Express

DOT # 12345

Physical Address

Launch Pad Road

Yourtown, Ourstate 12345

Mailing Address

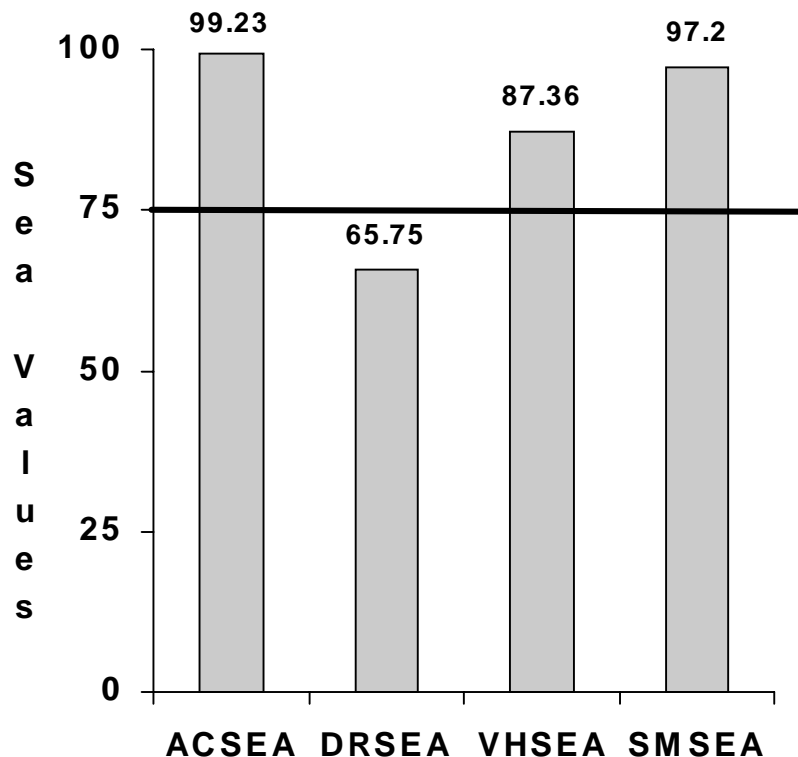
P.O... BOX 1234

Yourtown, Ourstate 12345

Power units: **35**

Hazmat Carrier: **yes**

Passenger Carrier: **No**



SafeStat Score: 383.02

Overall Rank: 19

State Rank: 3

**Previous Status: Warning
letter**

Current Status:

***Category A (At Risk)
CR Recommended***

SafeStat Effectiveness Study

A study was conducted to confirm SafeStat effectiveness by comparing post-run crash rates for scored vs. unscored carriers:

- (1) SafeStat was run 18 months in the past with data available at that time to identify and score carriers
- (2) Carriers with sufficient data were assigned to 3 groups based on the SafeStat run results: At-Risk (Categories A&B), Other Scored (Category C) and unscored
- (3) Post-run crash rates for each group were observed and compared

Effectiveness Study Results

Carriers identified by SafeStat have higher crash rates than carriers not identified by SafeStat

